CHAPTER – II

REVIEW OF RELATED LITERATURE

A literature review is a body of text that aims to review the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic. Its ultimate goal is to bring the reader up to date with current literature on a topic and forms the basis for another goal, such as future research that may be needed in the area. It gives an overview of what has been said, who the key writers are, what are the prevailing theories and hypotheses, what questions are being asked, & what methods and methodologies are appropriate and useful. As such, it is not in itself primary research, but rather it reports on other findings.

The present reviews are based upon the available literature in respect to the study under investigation and therefore confined to the studies to which the investigator has accessed. All the relevant literature thus obtained by the researcher has been presented in this chapter to furnish necessary background material to evaluate the significance of the study.

The research scholar has made every possible effort to go through the literatures related to the problem in the circuit and aerobic training wherever available. The scholar has gleaned through almost every source like research quarterly, journals of various kinds, periodicals, encyclopedias, relevant book and e-resources. However, the scholar has also gone through the literatures of allied studies to collect the necessary information for making a proper shape of the study.
2.1 STUDIES ON AEROBIC TRAINING

Felipe et al., (2018) examined the effect of continuous aerobic training (CAT) in hypertensive, obese people. Seven patients of average age (45.3±3.9 years), height (1.63±0.1 m), body weight (89.09±22.0 kg), and body mass index (33.44±8.6 kg/m2) were subjected to the training. CAT was performed in thrice-weekly nonconsecutive sessions (90 min per week) with intervals of 48 hr between each session. The training sessions entailed 30 min of walking at an intensity of 70%–80% of the maximum heart rate (MHR) on a treadmill over a period of eight weeks, giving a total of 24 sessions. Through correlation analyses, we found significant improvement in the systolic pressure ($R=0.5675, P=0.0253$) and diastolic pressure ($R=0.7083, P=0.0088$) when the last session was compared to the first session of training. We found no differences in the diastolic pressure and systolic pressure before, during and after 15 min of the protocol exercise. The program showed a large effect size (ES) for systolic pressure (ES=0.85) and a small ES for diastolic pressure (ES=0.33). We found no differences in the blood pressure (BP) and heart rate (HR) during and after the training of obese hypertensive humans, but we found a positively significant correlation between HR and BP in the last session and a large ES, suggesting that this protocol exercise might have significance effect in the long term.

Guo (2018) observed the effect of aerobic exercise on the weight loss effect of obese female students. 100 cases of female college students with weight over 58 kg were selected and evenly divided into two groups. The experimental group took aerobic exercise while the control group was given oral calcium private to lose weight. The physiological and biochemical indicators of both groups before and after experiment were observed. Results: After the experiment, the weight, body fat content, WHR, BMI,
and blood lipid level of both groups reduced significantly. The differences were statistically significant, with P<0.05. The effect of the experimental group was significantly better than the control group. The weight loss and physical and mental health condition of the experimental group were better than the control group. The difference was significant, with P<0.05. Aerobic exercise shows good effect on the weight loss of female college students, with promoting their physical and mental health. The significant effect of aerobic exercise makes it worth clinical promotion.

Gary et al., (2017) examined the effects of aerobic and resistance training, and their combination on health-related quality of life (HRQoL) in adolescents with overweight or obesity. After a 4-week run-in period, 304 (91 males, 213 females) post-pubertal adolescents aged 14–18 years, were randomized to 4 groups for 22 weeks of: aerobic training (n = 75), resistance training (n = 78), combined aerobic and resistance training (n = 75), or no exercising control (n = 76). All participants received dietary counseling with a daily energy deficit of 250 kcal. Indicators of HRQoL such as overall HRQoL, and physical and psychosocial (an aggregate of emotional, social, and school functioning) HRQoL at baseline and 6 months post intervention were measured by the Pediatric Quality of Life questionnaire. The trial began in March 2005 and was completed in June 2011. In the intention-to-treat analyses, all groups showed significant improvements at 6 months on all HRQoL indicators. The aerobic group showed greater improvements than controls on physical HRQoL (mean differences of 5.5; 95% CI; 1.4–9.6, p = 0.009). In participants with ≥70% adherence, combined training produced greater improvements than control on overall HRQoL (mean differences of 4.8, 95% CI; 0.7–9.0, p = 0.02), physical HRQoL (mean differences of 5.8; 95% CI: 0.6–10.7; p = 0.03), social HRQoL (mean differences of 7.6; 95% CI: 1.0–14.2; p = 0.02), and school-
based HRQoL (mean differences of 7.6; 95% CI: 1.0–14.2; \( p = 0.02 \)). These findings highlight the potential importance of including resistance exercise into traditional aerobic exercise programs to maximize HRQoL in adolescents with obesity.

Pintu (2018) studied the effectiveness of six weeks aerobic dance exercises with music on Selected Health Related Fitness Parameters among Adolescent School Girls. Materials and Methods: A total of 20 adolescent girls student were randomly chosen from the class VIII of a Govt. secondary school of Kolkata. The age of the student was in between 13 to 14 years. The body fat percentage (PBF), muscular strength (MS) and muscular endurance (ME) were considered as criterion measure of this study. The instruments and tools used in this study to collect the data were AAHPERD Health Related Physical Fitness Test and skin fold calipers. Aerobic dance exercise programme was scheduled as five days per week basis for a period of six week continuously. The exercise set was repeated 4 times in each day. Duration of the exercise programme was 45 minute per day. Single experimental group design was adopted for this study. The mean and standard deviation were used as descriptive statistics. Difference between post test means and pre test mean were computed by t-test. Only 0.05 level of significance was considered in this study. All calculations were done using Excel 2007 software. Results: Results revealed that the pre-test mean value for PBF, MS and ME were 25.27, 22.52 Kg and 21.04 t/m respectively. The post-test mean value for PBF, MS and ME were 24.06, 27.61 Kg and 26.43 t/m respectively. The statistical calculations revealed that both the t-value for MS (t=2.30) and ME (t=2.47) for pre and post test were statistically significant (\( p<0.05 \)). But the computed t-value for PBF (t=0.33) between pre and post test was found statistically insignificant (\( p>0.05 \)). Conclusion: On the basis of results the study was concluded that six-week
aerobics dance practice has significant effect on muscular strength and muscular endurance but has insignificant effect on body fat percentage among the adolescent school girls.

Rajkumar & Malipatil (2018) studied the effect of aerobic training on selected physical and physiological variables. For the present study 30 male students from Agriculture College, vijayapur. Were selected randomly as the subjects for the study. The age of the subjects ranged between 18 - 21 years the variables selected for the present study were aerobic training (independent variable), muscular endurance, cardio-respiratory endurance, Resting Heart Rate and Vital Capacity. For the study pre test – post test randomized group design; the subjects were further classified at random into two equal groups. Group - I underwent aerobic exercises for five days per week for eight weeks experimental group (15 students) and group - II acted as control group (15 students) was used. The data were collected through the pre test, before training and post test, after eight weeks of aerobic exercises training. For comparing pre and post test means of experimental and control groups of selected physiological variables, descriptive analysis and Analysis of Co-Variance (ANCOVA) were used, the data analyzed with the help of SPSS (16.0 version) software and the level of significance was set at 0.05 level of confidence. The result of the study showed that there was significant difference between pre and post test (experimental group) of muscular endurance, cardio-respiratory endurance, Resting Heart Rate and Vital Capacity, Another hand there was insignificant difference between pre and post test (control group) of muscular endurance, cardio-respiratory endurance, Resting Heart Rate and Vital Capacity. On the basis of the findings it was concluded that the aerobic training might be responsible for the improvement of selected physical and physiological
variables. Like muscular endurance, cardio-respiratory endurance, Resting Heart Rate, Vital Capacity (VC).

**Sonia et al., (2018)** conducted a study with the objective to test the effect of step aerobic training for six weeks with 6 inches step platform at 118 and 126 beats per minute (BPM) on selected kinematic (Partial Temporal) variables. The study was delimited to female subjects only (N=30), age ranging from 18 to 22 years and the intensity of training set to 118 and 126 beats per minute as protocol 1 and protocol 2 respectively. The study delimited to selected kinematic (Partial Temporal) variables namely as Leg Step up, Leg Step down, Upward Arm Swing, Downward Arm Swing and Ratio Variables. The Data Recording and quantification for pre test and post test were administered by Video Analysis (analysis for partial temporal variables) post test was conducted immediately after step aerobic training for 6 weeks with six inches step platform at 118 BMP as well as 126 BMP independently. Collected data was computed with mean, standard deviation and t-test. The selected variables for the study were Leg Step Up Variable-Right (T1), Leg Step Up Variable-Left (T2), Leg Step Down Variable-Right (T3), Leg Step Down Variable-Left (T4), Upward Arm Swing Variable (T9), Downward Arm Swing Variable (T10), Ratio Variables (T17-T32). It was concluded that there was significant effect of step aerobic training on the selected kinematic (Partial Temporal) variables namely as T1,T2,T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13,T14,T15,T16, T17, T18, T19, T20, T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31 and T32 in both of the protocols. Effect of step aerobic training for six weeks in different protocol were found to be significant for biomechanical adaptation. All the selected kinematic (temporal) variables supported
each other as per the existing literature or research and were found suitable for step aerobic training evaluation.

**Sunanth & Sudheer (2018)** assessed the effect of Yoga and Aerobic exercises among the cricket players. The subjects for the study were 30 cricket players who had participated in intercollegiate competitions. Three groups were formed, each with 10 players. Group A and Group B was experimental group whereas Group C was control group. The variables selected for the study was Speed, Agility and Leg strength. For the study the Group A and B had to undergo a training of Yoga and Aerobic exercise for a stipulated period respectively. The statistical procedure used for the study was analysis of co-variance and find out the paired mean significant different Scheffe’s Post-Hoc Test was used. The test followed by training showed significant improvement in the selected variables—speed, agility and leg strength for cricket players to come out with flying colors.

**Tangarani & Gajanana (2018)** lack of physical activity and an uncontrolled diet cause excessive weight gain, which leads to obesity and other metabolic disorders. A sedentary lifestyle poses a threat to individuals’ health because it can lead to an increase or progression in the risk of hypertension, obesity, muscle weakness, postural defects, and lean body mass. Measurement, assessment and monitoring of BC in humans have been three of the main challenges for health sciences professionals. Effective weight management strategies consider not only weight loss toward but also the maintenance of a healthy body weight over time. The researcher was interested in assessing the effects of twelve weeks’ aerobic dance training program on body composition of young women. The body composition was assessed using waist to hip ratio and skin fold. The study was a one group pre-test post-test design with thirty
subjects. The subjects selected for the study were post-graduate female students studying during 2017-18 at Kuvempu University, Shankaraghatta. Their age ranged between 20 to 25 years. All the subjects were residents of women’s hostel within the main campus. The criterion measures of body composition were waist to hip ratio and skin fold measurements at four sites. Descriptive statistics like mean and standard deviation were employed on the raw scores during pre and post-test situations. The differences between mean scores were calculated using ‘t’ test for paired samples. Findings of the study are discussed in detail. Within the limitations of the present study, it is concluded that the exercise intervention in the form of aerobic dance performed for twelve weeks is effective in reducing body fat in young women.

Zaffer et al., (2018) examined the effect of aerobic training on flexibility among endomorph students of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. Data was collected on individually through 30 Control and 30 Experimental group of subjects. The age range between 18±28 years was selected as the subject for the study. The instruction of training was given by researcher every day before starting the training in Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. Purposive sampling was used for collection of data. The data were analyzed using descriptive and ‘t’ test. Only one variable of Physical fitness component was selected as the independent variable i.e. flexibility and sit and reach test was used for this study. The mean value and standard deviation of control group and experimental group in relation to flexibility of endomorph students was (1.75#4.03pre), (2.01#3.82post) and (2.21#3.53pre), (4.11#3.82post) respectively. Calculated t–ratio of control and experimental group was found 0.257 and 2.054 in relation to flexibility. The results of this study on the basis of statistical analysis states that the significant results were
drawn. The experimental group have more efficient flexibility level than of the control group. Further the study reveals that aerobic training has all the essentials to improve flexibility level.

Rajkumar & Savitri (2017) examined the effect of aerobic exercise training on hematological variables among college women’s. For the present study 30 college women’s from Sri B.M. Patil PU College Bijapur. Were selected at random and their age ranged from 18 to 25 years. For the present study pre test – post test randomized group design which consists of control group and experimental group was used. The subjects were randomly assigned to two equal groups of fifteen each and named as Group ‘A’ and Group ‘B’. Group ‘A’ underwent aerobic exercise training and Group ‘B’ underwent no training. The data was collected before and after twelve weeks of training. The data was analyzed by applying Analysis of Co-Variance (ANCOVA) technique to find out the effect of aerobic exercise training programme. The level of significance was set at 0.05. The findings of the present study have strongly indicates that aerobic exercise training of eight weeks has significant effect on selected hematological variables i.e., RBC and WBC of college women’s. Hence the hypothesis earlier set that aerobic exercise training programme would have been significant effect on selected aerobic exercise training variables in light of the same the hypothesis is accepted. Significant effect of aerobic exercise training was found on RBC and WBC.

Siva Sangari (2017) the aerobic and zumba training is a dance fitness training that incorporates some of the basic principles of interval, resistances, polymeric training to maximize caloric output and improve cardiovascular endurance. Now a day’s aerobic and zumba becoming a popular mode of exercise especially among women due to its dance steps and mind relaxing catchy music background. This study intend to prove
twelve weeks of aerobic and zumba training will show impact on cardiovascular endurance among middle-aged women which was held in step-up fitness center. To achieve the purpose of the study thirty subjects were selected and divided into two equal groups namely zumba training (ZT) and aerobic training (AT). Their age ranged between (30-40) and subjects were asked to do training for one hour for five days in a row as for the outcome 12-minutes cooper run and walk test was used to measure cardiovascular endurance. ANCOVA was used to find out the significant differences between the groups. The 0.05 level of confidence was fixed as the level of significance, which was considered as an appropriate. The result of the study revealed that there was a significant difference in cardiorespiratory endurance in zumba and aerobic training group.

Zahoor & Karthikeyan (2017) found out the impact of moderate and high intensity aerobic exercise on selected biomotor performance of college men football players. To achieve purpose of this study, 45 football players were selected from Government Boys Degree College Baramulla, State Jammu and Kashmir, India were selected as subjects at random, the age group of the subjects ranged between 17 to 22 years. The subjects were divided into three equal groups of 15 each. Group-I underwent moderate aerobic intensity training, group-II underwent high aerobic intensity training and group-III acted as control subjects, which didn’t participate in any special training apart from their regular activities. The following bio motor variables namely balance and coordination performance was selected as criterion variables. All the subjects of three groups were tested on selected dependent variables at prior to and immediately after the training programme. The ANCOVA (analysis of co variance) was used to analyze the significant difference, if any among the groups. The .05 level of confidence
was fixed as the level of significance which was considered as an appropriate. The results of the study revealed that there was a significant improvement on selected biomotor variables such as balance and coordination for moderate aerobic intensity training group and high aerobic intensity training group as compared to control group among college men football players.

Ozhan Bavl (2016) investigated the effects of eight weeks of step aerobic exercises on static balance, flexibility and selected basketball skills in young basketball players. A total of 20 basketball players (average age 16.1±0.7 years and average sporting age 4.1±0.7 years) voluntarily joined the study. Participants were randomly divided into two groups (experiment n:10 and control n:10). All participants attended basketball training 3 days per week but the experiment group also had step aerobic dance practice 2 days per week. Before and after the study static balance, flexibility and selected basketball techniques were evaluated. SPSS statistical program used for analysis. Repeated measures Anova was used to compare the pre-test and post-test measurements of the groups. The differences between pre-test and post-test measurements in the two groups were examined with the independent t-test. P< 0.05 is considered statistically significant in the interpretation of our results. After eight weeks of training, both two groups’ static balance and flexibility performances were significantly changed. But only the experiment group had significant improvement in the basketball skill test. The experiment group was also statistically changed in terms of all parameters compared to the control group. According to the results of this study it is possible to say that to improve basketball skills by improving balance and flexibility performance, eight weeks of step aerobic exercise is a useful training model for young basketball players.
Vivek et al., (2016) myocardial Infarction is the leading cause of global mortality. The prevalence rate is 30 million in India. Researchers have found that step aerobic exercise is more effective than other exercises in reducing body fat & blood pressure. This study was designed to examine the effects of moderate intensity step aerobics on heart rate, blood pressure, triglycerides, High density lipoprotein & Low density lipoprotein on a patient with acute Myocardial Infarction. A 55 years old male diagnosed with acute anterior wall Myocardial Infarction was selected for the study based on risk stratification schema two months post discharge from hospital. The exercise session consisted of a 3 phase exercise program 1) a warm-up (10 min of dance aerobics); 2) aerobic exercise training (20 min of step aerobics); 3) a cool-down (10 min of breathing and flexibility exercises) total 40 minutes duration and included three sessions per week. Exercise intensity was controlled by monitoring targeted heart rate. Measurements of Heart rate, Blood pressure were recorded before, at 5 min & 40 min post intervention. Triglycerides, HDL & LDL levels were measured at baseline and at 8th week post intervention. It shows variations in systolic blood pressure and heart rate at baseline and after 8 weeks. No difference in diastolic blood pressure. Significant difference between high density lipoprotein, low density lipoprotein and triglycerides level was observed at the end of 8 weeks. Our findings showed that step aerobics significantly improved heart rate, systolic Blood Pressure and experienced an increase in HDL. This type of currently ‘popularised’ low-cost step aerobic exercise has an important role in the prevention and reducing the morbidity of cardiovascular diseases.

Anek et al., (2015) developed an aerobic step combined with resistance training exercise program and to compare the effects of A) aerobic step exercise training (STE), B) resistance aerobic exercise training (RES), C) a combined aerobic step with
resistance exercise training (COM) on the health-related fitness, balance, and biochemical bone markers. Sixty participants were working female volunteers at the age of 35-45. They were divided into 4 groups by simple random sampling method. Fifteen of the participants were in the STE group, 14 in the RES group, 15 in the COM group, and 16 in the control group (CON). The STE, RES and COM exercise training programs were designed to yield the same intensity and achieve the same range of heart rate during each stage of the program. During the training, music was used to set the tempo of the workouts. At the 8th week, it was found that resting heart rate and systolic blood pressure significantly increased only in the STE and COM groups. After 16 weeks, the experiment results showed the significant improvement in the COM and STE groups of exercise training for $\beta$-CrossLaps, P1NP NMID Osteocalcin and bone formation (PINP/$\beta$-Cross Laps x0.31) but not in the RES group. For balance ability, the COM group showed significantly greater change than the RES group after the training intervention ($p < 0.05$). It can thus be concluded that the STE and COM training were effective in improving bone formation (PINP/$\beta$-Cross Laps x 0.31) but not in the RES group. For balance ability, the COM group showed more significant change than the RES group. Therefore, this is not only a good exercise choice for the working-age people but also it can help reduce the risks of osteoporosis and falling in women in particular.

Jayachandran (2015) examined the effect of yogasana and step aerobic exercises on selected physiological parameters. To achieve these purpose 45 school boys’ students were selected from Chidambaram region selected as subjects. Their age group ranged from 14 to 16 years. They were divided in to three equal groups of 15 subjects each and assigned to Experimental group-1, Experimental group-2 and control
group. The group-1 underwent yogasanas+ pranayama exercises and the group-2 utilized step aerobic training. The experimental groups underwent their respective training programme three days per week (alternate days) for twelve weeks. The criterion variables selected are resting pulse rate, vital capacity and breath holding time. ANCOVA was used to find out the significant differences. Statistical analysis found significant differences between yogasanas exercises and step aerobics training in improving the physiological parameters. Step aerobics training differed significantly \((p<0.05)\) from both yogasanas exercises and control groups for resting pulse rate. Both experimental groups improves breath holding time when compare to control group.

**Rifat et al., (2013)** investigated the effects of eight-week step-aerobic exercise programs on flexibility, body weight, body fat percentage and body circumference measurements of sedentary women. 20 sedentary female volunteers participated in the study. Step-aerobic exercises were applied to for every participant for 8 weeks, three days a week and 45 minutes per day. Data were analyzed by using SPSS 17.0 software. For statistical analysis, Paired-t test was used. Significance level was determined to be 0.05. Significant differences were found between mean values of pre-and post-tests (flexibility = 3.35cm; body weight = 4.48 kg; body fat percentage = 3.39%, and the number of heart beats = 4 beats/min) \((p<0.05)\). As a result of the step-aerobic exercises, flexibility and all parameters related with the body composition of the individuals were changed positively. The study showed similarity with the results of other studies.

**Vallimurugan (2013)** examined the effect of aerobic dance training on haematological variables among Ball Badminton players. For the present study 30 female ball badminton players from Selvam Group of Institutions, Namakkal, Tamilnadu were selected at random and their age ranged from 18 to 25 years. For the...
The present study pre-test–post-test randomized group design which consists of control group and experimental group was used. The subjects were randomly assigned to two equal groups of fifteen each and named as Group ‘A’ and Group ‘B’. Group ‘A’ underwent aerobic dance training and Group ‘B’ underwent no training. The data was collected before and after twelve weeks of training. The data was analyzed by applying Analysis of Co-Variance (ANCOVA) technique to find out the effect of aerobic dance training programme. The level of significance was set at 0.05. The findings of the present study have strongly indicates that aerobic dance training of twelve weeks has significant effect on selected haematological variables i.e., RBC and WBC of ball badminton players. Hence the hypothesis earlier set that aerobic dance training programme would have been significant effect on selected aerobic dance training variables in light of the same the hypothesis is accepted. Significant effect of aerobic dance training was found on RBC and WBC.

Yasmina et al., (2013) investigated the effects of 8-week step aerobic exercises on young women’s physiological characteristics, body fat percentage and quality of life. In so doing, 15 active women with the mean age 26/24 ± 5/86 years, mean weight 61/26 ± 10/85kg, and mean height 160/70 ± 6/25 cm as well as 15 employed women with the mean age 25/94 ± 5/88 years, mean weight 61/60 ± 10/95 kg, and mean height 162/33 ± 6/07 cm voluntarily participated in the study. First, the participants filled out a personal information questionnaire; then, a pretest was conducted, which incorporated tests of Profile Of Mood States (POMS) questionnaire, and tests of height, weight, subcutaneous fat, sit and reach, dyno drag, and strand to measure variables of bewilderment, vitality, fatigue, height, weight, fat percentage, flexibility of back, the strength of back muscles, and maximum oxygen uptake, respectively. Then, the
participants of both groups did step aerobic exercise for 8 weeks – 3 sessions of 50 to 60 minutes per week. The same tests were embedded in the post-test. For statistical analysis, descriptive statistics and as for the comparison of the two groups, SPSS was used to perform Mann–Whitney test (p<0.05). The results confirmed that step aerobic exercises lead to a significant decrease in fat percentage (p=0.02); however, they increase flexibility (p=0.003), back muscle strength (p=0.003), and maximum oxygen uptake (p=0.000), relieve fatigue (p=0.02) and bewilderment (p=0.01), and finally boost vitality (p=0.02) as well. Generally, doing step aerobic exercises has a dramatic and positive effect on women’s physiological characteristics and the quality of their lives. Therefore, it seems necessary to repeat the exercises more and concentrate on the strength of upper body muscles.

Ravinder, et al., (2012) concluded the aerobic training reduce the Total Cholesterol, Triglycerides and LDL cholesterol levels. Different types of exercise programms on the lipid profiles of the individuals might contribute for the enhancement of knowledge in this area, and will be certainly useful to create different protocols of exercise to different individuals basing on the requirements of the individuals. Awareness of Anaerobic training and Aerobic training will help in creating new ideas, and may lead to considerate the knowledge on the effects of exercise on the individuals health related physical fitness. Lack of exercise (Detraining) for one month may increase the Total Cholesterol, Triglycerides and LDL cholesterol levels.

Smol & Fredyk (2012) investigated whether 6-week low-intensity aerobic training program used as a supplement to regular dance practice might improve both the aerobic capacity and psychomotor performance in female ballet dancers. To assess their maximal oxygen uptake (VO2max) and anaerobic threshold (AT), the dancers
performed a standard graded bicycle ergometer exercise test until volitional exhaustion prior to and after the supplementary training. At both these occasions, the psychomotor performance (assessed as multiple choice reaction time) and number of correct responses to audio-visual stimuli was assessed at rest and immediately after cessation of maximal intensity exercise. The supplementary low-intensity exercise training increased VO2max and markedly shifted AT toward higher absolute workload. Immediately after completion of the graded exercise to volitional exhaustion, the ballerinas' psychomotor performance remained at the pre-exercise (resting) level. Neither the resting nor the maximal multiple choice reaction time and accuracy of responses were affected by the supplementary aerobic training. The results of this study indicate that addition of low-intensity aerobic training to regular dance practice increases aerobic capacity of ballerinas with no loss of speed and accuracy of their psychomotor reaction.

Wu, et al., (2012) participation in aerobic dance is associated with a number of lower extremity injuries, and abnormal joint loading seems to be a factor in these. However, information on joint loading is limited. The purpose of this study was to investigate the kinetics of the lower extremity in step aerobic dance and to compare the differences of high-impact and low-impact step aerobic dance in 4 aerobic movements (mambo, kick, L step and leg curl). 18 subjects were recruited for this study. High-impact aerobic dance requires a significantly greater range of motion, joint force and joint moment than low-impact step aerobic dance. The peak joint forces and moments in high-impact step aerobic dance were found to be 1.4 times higher than in low-impact step aerobic dance. Understanding the nature of joint loading may help choreographers develop dance combinations that are less injury-prone. Furthermore, increased
knowledge about joint loading may be helpful in lowering the risk of injuries in aerobic dance instructors and students.

Kalapotharakos, et al., (2011) examined the seasonal changes in body composition and aerobic performance in elite soccer players. Twelve elite professional soccer players (aged 25 ± 5 years, weight 75.7 ± 5.3 kg, height 1.79 ± 0.06 m) were measured for body fat (%), maximum oxygen consumption (Vo2max), running velocity at Vo2max (vVo2max), running velocity at a fixed blood lactate concentration of 4 mmol-L~1~ (v-4 mM) at the start of the preseason period, at the beginning of the competitive period and at midseason. Vo2max, v-4 mM, and vVo2max increased significantly (p < 0.05) by 4.5, 10.5, and 7.8, respectively, after the preseason period. Thereafter, the aerobic performance parameters remained relatively constant, with no significant changes throughout the competitive period. The results of this study suggest that moderate improvements were observed in Vo2max and the %Vo2max at 4 v-4 mM, whereas higher improvements were observed in Vo2max and v-4 mmol-L~1~ after the preseason training period. On the other hand, during the competitive period, aerobic performance remained unchanged. In addition, this study suggests that heart rate, lactate, Vo2, and Vo2max are useful and practical predictors that help monitor aerobic performance changes during a soccer season.

Nagaraj, et al., (2011) studied effect of stretching exercises and aerobic exercises on flexibility of school boys. For this study sixty school boys were selected at random from Velankanni Matriculation Higher secondary school, Puducherry and their age ranged from 14 -17 years. The selected subjects divided in to four groups each group consist of fifteen subjects. Group I underwent stretching exercises, group II underwent aerobics exercises, group III underwent combined exercises (stretching and aerobics
exercises) and group IV is control group. The three experimental groups were subjected to the training programme for 10 weeks for three days per week. Control group did not undergo any training programme rather than their routine work. Flexibility was measured by using sit and reach box. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Covariance. The result shows that combined exercises (stretching and aerobics exercises) were significantly better than stretching exercises, aerobics exercises in flexibility.

Smol & Fredyk (2012) examined the effect of aerobic exercise training on vagal and sympathetic influences on the modulations of heart rate and systolic blood pressure in response to an oral glucose load in obese individuals with and without type 2 diabetes mellitus (T2D). Beat to beat arterial pressure and continuous electrocardiogram were measured after a 12-hour overnight fast and in response to glucose ingestion (75 g dextrose) in obese subjects with (T2D group, n = 23) and without (OB group, n = 36) T2D before and after 16 weeks of aerobic exercise training at moderate intensity. Autonomic modulation was assessed using spectral analysis of systolic blood pressure variability (BPV), heart rate variability (HRV), and analysis of baroreflex sensitivity (BRS). Glucose ingestion significantly increased low frequency (LF(SBP)), lowfrequency HRV (LF(RRI)) and the ratio of low to high frequency components of HRV (LF(RRI)/HF(RRI)) and decreased the high frequency power (HF(RRI)) (P < .05). Exercise training increased LF(RRI) and LF(RRI)/HF(RRI) responses and reduced HF(RRI) and LF(SBP) to glucose ingestion in both groups (P < .05), but increased fasted BRS in the OB group only (P < .05); glucose intake had no effect on BRS (P > .05). In conclusion, a 16-week exercise training program improved cardiac autonomic
modulation in response to an oral glucose load in obese adults, independently of diabetes status and in the absence of remarkable changes in body weight, body composition, fitness level and Glycaemic control.

**Smol & Fredyk (2012)** studied the effect of 12 weeks aerobic exercises on selected health related physical fitness and physiological variables among adolescents. Thirty healthy, untrained school boys were selected from Sengunthar higher secondary school in Thuraiyur and their age ranged from 12 to 15 years. The subjects were equally divided into two groups namely control and experimental group. The experimental group underwent aerobic exercises training for forty five minutes duration for twelve weeks for weekly five classes. Control group was kept under observation without training. Selected health related variables were, muscular strength was measured using by hand grip dynamometer, muscular endurance was measured using by bent knee sit ups, cardio-respiratory endurance was measured using 12- minutes run/walk, flexibility was measured with the reliable equipment sit and reach box. The body mass index was calculated by measuring the height and body weight of the subjects. The height was measured in meters by using a stadiometer and weight was measured in kilograms by using a weighing machine. The following equation was used to calculate the body mass index (BMI) i.e. BMI= weight in kg/ height in meter square. The results of pre- test and post- test were compared by using Analysis of Covariance (ANCOVA). All variables were significantly improved among experimental group.

**Ravikumar (2009)** conducted a study to find out the effect of selected yogic practices and aerobic exercises on somato type components and its relationship with health related physical fitness and biochemical variables. Forty-five college male students were selected randomly from in the Government boys’ hostel, lawspet,
Puducherry. Their age ranges from 18 to 25 years. They were divided into three groups namely control group, yogic group and aerobic group. The training period the yogic group and the aerobic group underwent fourteen weeks of training on their respective program. The yogic group was trained on asanas and pranayama. The aerobic group was trained on aerobic exercises with rhythmic music with various types of aerobic type movements. The progressive load method was used up to fourteen weeks for the respective groups. The training was given during for 5 days a week. The data pertaining to pre test and post test of experimental variables were derived through the following methods. Health related physical fitness components such muscular strength and endurance, muscular flexibility, cardiovascular endurance & body composition significantly improved after yogic group and aerobic exercise group than the control group.

Preetha (2006) conducted a study to find out the effect of selected yogasanas and aerobic exercises on selected physical, physiological and psychological variables among women students of Pondicherry University. Samples were selected randomly aged between 20 to 25 years and was divided into equally three groups Control and two experimental groups. Experimental group I underwent aerobic exercises, experimental group II underwent yogasana practice the both group the training session were held five days in a week for a period of twelve weeks. Control group did not undergo any training. Prior to and at the end of training period all subject were tested for selected physical, physiological and psychological variables. Aerobic exercises & yoga practice group showed significant improvement on selected physical, physiological and psychological variables like weight, flexibility, and balance among experimental group than the control group.
Tiken, et al., (2002) has conducted a study to find out the influence of specific yoga and aerobic exercise on physical fitness of SAI (NERC IMPHAL) STC Athletes. 30 boys and 30 girls from SAI NERC Imphal were divided into two groups according to their mean age and height of 17.5 years and 15 years and 172.8 cms and 156.4 cms respectively. Training was given twice in a week for four months. Vertical jump to test explosive power, pushups and sit ups to test strength endurance, sit and reach to test flexibility, 50 yards dash to test speed and 12 min run walk to test endurance were conducted for aerobic exercise and yoga group before the training and after the two months and four months of training. It was concluded that (i) Improvement of physical fitness assessed on three selected physical fitness tests after four months of yoga and aerobic had justified the fact that both yoga and aerobic exercise were effective in developing physical fitness and (ii) in yoga and aerobic exercise groups, boys were found superior to girls group in sit and reach (flexibility) and 12 min run – walk (endurance), 50 yards (speed).

Sakthignanavel (1998) studied the effect of pranayama and aerobic exercises on physical and mental performance among males. The present investigation was undertaken to study the effect of pranayama with aerobic exercises on muscular endurance, vital capacity and cardio respiratory endurance. Thirty normal male volunteers had undergone a 12 weeks training course of pranayama (n1=10), aerobic exercise (n2 =10) and pranayama with aerobic exercises (n3=10). The suitable parameters were assessed before and after the training. The results shown that the pranayama group marked as higher degree in vital capacity (p<0.05). The aerobic group shows greater cardio respiratory endurance and muscular endurance than the other
groups (p<0.05). The combined pranayama aerobic group shown a greater improvement in all aspects than the other three groups (p<0.05).

Mosher, et al., (1994) determined the effects of a combined aerobic and circuit weight training program on maximal oxygen consumption, body composition and muscular strength of college-age women. Of the 33 who volunteered to participate, 17 were randomly assigned to the exercise program while the remaining 16 served as controls. The training involved a 45-min circuit of 30 activities including five 3-min aerobic exercises and 25 30-sec weight training or calisthenics exercises. The subjects exercised at 40 to 50% of their 1-RM for each weight station. Workloads for the aerobic stations were assigned based on the workload needed to elicit 75 to 85% of the maximal heart rate reached during the [latin capital V with dot above] O2 max test. Data were analyzed using a repeated measures ANOVA with significance established at p < 0.05. The exercise group had significant increases in [latin capital V with dot above] O2 max, upper body strength and lower body strength, and significant decreases in skin fold sum and percent body fat. This indicates that an aerobic circuit weight training program is an effective way to improve cardiovascular fitness, body composition and muscular strength in college-age women.

2.2 STUDIES ON CIRCUIT TRAINING

Khurshid & Patil (2018) examined the effect of weight training and circuit training on selected health related physical fitness component among post graduate students of Swami Ramanand Teerath Marathwada University Nanded and one variable was selected that is Flexibility. Data was collected on individually through 30 control and 30 experimental group of subjects of Swami Ramanand Teerath Marathwada
University Nanded on athletic track. The age range between 18±28 years was selected as the subject for the study. The instruction of training was given by researcher every day before starting the training in Swami Ramanand Teerth Marathwada University Nanded Maharashtra. Simple random sampling was used for collection of data. The data was analyzed using descriptive and t test. Only one variable of health related Physical fitness component was selected that is Flexibility and Sit and Reach test was used in this study. The mean value of control group and experimental group in relation to flexibility of post graduate students was (1.75pr #2.01ps) and (2.21pr# 4.11ps) respectively in relation to Flexibility. Calculated t–ratio of control group was 0.257 and experimental group was 2.054 in relation to Flexibility. Significant effect of weight training and circuit training on selected health related physical fitness component was found among post graduate students of Swami Ramanand Teerath Marathwada University Nanded, in relation to Flexibility.

Ab Raoof et al., (2017) investigated the influence of circuit training on agility among college students. Thirty male college students (n=30) were randomly selected as subjects and their age ranged between 18 and 22 years. The 45 selected subjects were randomly assigned into two equal groups such as circuit training group (CTG) and control group (CG) with fifteen subjects each (n=15). The experimental group underwent their respective experimental treatment for eight weeks three days per week and a session on each day. Control group was not undergone any specific training apart from their regular activities. Agility was taken as dependent variable for this study and it was measured by shuttle run. The collected data was analyzed by using analysis of covariance (ANCOVA). The result revealed that the circuit training group produced significant improvement (p≤0.05) on agility as compare to control group.
Maniazhagu et al. (2017) examined the effects of explosive strength and strength endurance based circuit training on speed performance. To achieve the purpose of the study, thirty boys’ student in the age group 13 to 14 were selected as subjects at random. The selected subjects were from RCM High School, Natarajapuram, Sivagangai(DT), Tamilnadu. The study was formulated as pre and post-test random group design, in which thirty students were divided into three equal groups. The experimental group-1 (n=10, ESbCT) underwent explosive strength based circuit training, the experimental group-2 (n=10, SEbCT) underwent strength endurance based circuit training and group 3 served as control group (n=10, CG) did not undergo any specific training. In this study, two training programme were adopted as independent variables, i.e., explosive strength based circuit training and strength endurance based circuit training. The speed was selected as dependent variables. The speed was tested by 50 meters run recorded in seconds. The selected two treatment group namely explosive strength based circuit training and strength endurance based circuit training were performed five days in week for the period of six weeks, as per the stipulated training programme. The speed performance was collected before and after the training period. The collected pre and post test data was critically analyzed with apt statistical tool of one way analysis of co variance, for observed the significant adjusted post-test mean difference of three groups. The Scheffe’s post hoc test was used to find out pair-wise comparisons between groups. To test the hypothesis 0.05 level of significant was fixed in this study. The nature of speed highly improved in explosive strength based circuit training than the strength endurance based circuit training.

Sunita & Ashok (2017) explored the effects of Circuit Training on selected physical fitness variables of sportspersons. State level healthy male players of Athletics,
Football, Cricket and Hockey were selected for experimentation. Total subjects were 28, ranging 15-19 years of age. All the subjects were divided into two equal groups i.e. Experimental group (n=14) and Control group (n=14). Experimental group was given Circuit training program while Control group was not given any specific training programme. 6 weeks training programme was designed and the subjects were required to attend five days training programme in a week. AAHPER youth fitness test (Revised edition: 1976) was used to collect pre and post test data on selected physical fitness variables. Paired t-test was used to check if any significant difference exists or not between pre and post-test scores of Circuit training group and pre and post test scores of Control group. Independent t-test was employed to check significant difference between pre scores of Circuit training and Control group and post-test scores of Circuit training and Control group and mean, S.D and t-ratio were tested. It was concluded on the basis of results that Circuit training have significant effect on all selected physical fitness variables.

Febin & Robert (2016) examined the effect of aerobic exercise and circuit training on obesity among school student. To achieve this purpose, forty five school student aged between 14 to17 years, studying in the ONGC public school children were selected. The subjects were divided into three equal groups of fifteen subjects each, namely aerobic exercise group, circuit training group and control group. The aerobic exercise group was given cycling, calisthenics, rhythmic exercises, continuous slow running. Circuit training group was given bench press, half squats, standing jumps daily for twelve weeks. Weight was tested before (pre) and after (post) the training programme for both experimental and control group by using Waist circumference. ANCOVA was used to find out the significant difference if any between the groups. The
results of this study indicate that the Aerobic exercise group has significantly improved from circuit training and control group the selected dependent variable namely waist circumference. However control group did not show any improvement on the obesity as it was not involved in any of the specific training programme.

**Sudhir Dnyaneshwarrao Pathare (2018)** The purpose of the study was to determine effects of six week yogic practice on selected health related physical fitness components. To achieve, this purpose forty school boys were selected at random from school of Amravati district. The age level of the subjects ranged from 13 to 15 years. They were divided in to two groups and designed as experimental group ‘A’ and control group ‘B’. The experimental group-A was given yogic practice for a period of six weeks, morning for five days a week, Whereas the control group ‘B’ did not involve in any specific exercise programme and training other than their regular physical activities as per their school curriculum. To find out the muscular strength, muscular Endurance and cardio respiratory endurance, grip dynamometer, sit ups (bent knees) and 12-Min run /walk was used. The data thus collected were put to statistical treatment computing independent ‘t’ test to find out the differences, if any between the before and after test. Further the level of significance was set at 0.05. In this research it is observed that there has been significance difference between the before and after test experimental group in muscular strength, muscular endurance and cardio respiratory endurance. This study indicated that regular yogic practice is beneficial for human health and future generation.

**Karuna Sana and Rita Bala Roy (2017)** Purpose of the present study was to find out the influence of physical education programme on health related physical fitness of female students in respect to general education programme. For conducting
this study total fifty female students [25- M.P.Ed and 25- M.Ed girls students] of 25 to 30 years old were selected randomly from S.I.P.E.W Hastings House and B.Ed college, Hastings House. Criteria measured for conducting this study were age, height and weight as personnel data and muscular strength, flexibility, cardiovascular endurance as health related physical fitness components. The data were collected by standard tools and techniques. Mean and standard deviation was used as descriptive statistics, t-test was used to measure the significance of difference between two groups. Result of the present study revealed that there were significant differences between the M.P.Ed and M.Ed girls students on explosive strength, flexibility, and muscular endurance and Students of Physical Education were the better performer than the students of general education. So, it can be concluded that physical education programme has a significant positive influence on healthy living.

AE Nelson Raj et al., (2016) The purpose of this study was to find out the status of the health related physical fitness components among middle aged police Professionals. Methodology: For the purpose of the study 100 subject were selected from Coimbatore. The subject’s age group ranged from 35 to 45 years. After a detailed orientation the selected Physical Fitness Components test were conducted to all the subjects. With help of the Physical Education teachers and the other police officers, the investigator was able to collect the data from the police Professionals. The trails were given and name, age, and performance scores were recorded for each and every individual. Procedures: The following variables were determined for the study: Muscular strength endurance, flexibility, Cardio respiratory endurance and body composition. Statistical Tool: The descriptive statistics of mean and standard deviation was calculated to measure the status of health related physical fitness components of
middle aged police Professionals. Conclusion: The result of the study shows that there was significant changes of health related physical fitness components of middle aged police Professionals.

Suprova Dutta and Dr. Mahaprasad Ghosh (2016) Purpose of the study was to find out the health related physical fitness of 100 college women, age ranges 19-20 and 21-23, studying in State Institute of Physical Education for Women, Hasting House in Alipur, under Calcutta University were selected subject randomly and divided into two groups consisting of 50 women in each. Group-I is B.P.Ed students and group-II is M.P.Ed students. The two groups were provided with same types of physical exercises, consisting of walking, jogging, floor aerobic exercises. Health related physical fitness variables are cardiovascular endurance, muscular strength, flexibility, and body composition. The results of this study proved that both group were good but M.P.Ed students are more fitness than B.P.Ed students. Even though it was found that M.P.Ed group was better than B.P.Ed, the difference between those two groups was significant at 0.05 levels, using t-test to make definite conclusion on each variables. It was observed that this study can be used in improving cardiovascular endurance, muscular strength, and flexibility among B.P.Ed students.

Lijesh Kumar P (2017) The study was aimed to make an analysis of selected anthropometric characteristics and sprint start performance of elite male athletes. Methods: Fifteen male elite athletes (sprinters) from the STC and COE schemes of Sports Authority of India, Thiruvanathapuram, were selected as the subjects for the study. Their age ranged from 16-29 years. 25 anthropometric measurements out of 39 measurements suggested by International Society of the Advancement of Kinanthropometric (ISAK) were selected as variables. Also video recording of sprint start of the athletes was selected as the test item. Result: The performance of the athletes
in the 10 metre increased with the increase in their body mass, sitting height, chest girth, biacromial breadth and A-P chest depth. Performance in the 10 metre sprint showed no significant relationship with the other selected anthropometric variables.

Conclusion: Block clearance of the sprint athletes is associated with many of their body features. Block clearance, velocity and sprint time are more dominant with the increased body mass, sitting height and chest girth of the elite male sprint athletes.

2.3 SUMMARY

The review of literature helped the investigator to spot out relevant topics and variables. Further the literature helped the investigator to frame the suitable hypothesis leading to the problems. The latest literature also helped the investigator to support his finding with regard to the problem. Further the literature collected in the study also helped the research scholar to summarize his study. The researcher has presented the reviews in the related subjects by depending upon the highly authentic sources. Each review has been written in details in related to my subject. Finally the researcher puts to an end to this chapter after giving all relevant details to each reviews of this chapter.

The reviews were presented under the sections such as conventional training and circuit training, aerobic training, Health related physical fitness, kinanthropometric, psychological. All the research studies presented in the section proved that both the training contribute significantly for better development of dependent variables. The research studies reviewed were collected from journals available in the websites and some university libraries.

Based on the experience gained through review of the studies, the investigator formulated suitable methodology to be followed in this research, which is presented in Chapter III.